The documentation and process conversion measures necessary to comply with this revision shall be completed by 22 June 2006.

INCH-POUND

MIL-PRF-19500/477G
22 March 2006
SUPERSEDING
MIL-PRF-19500/477F
7 June 2004

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, DIODE, SILICON, ULTRAFAST RECOVERY, POWER RECTIFIER,
TYPES 1N5802, 1N5804, 1N5806, 1N5807, 1N5809, AND 1N5811,
1N5802US, 1N5804US, 1N5806US, 1N5807US, 1N5809US, AND 1N5811US,
JAN, JANTX, JANTXV, JANS, JANHC, AND JANKC

This specification is approved for use by all Departments and Agencies of the Department of Defense.

The requirements for acquiring the product described herein shall consist of this specification sheet and MIL-PRF-19500.

1. SCOPE

1.1 Scope. This specification covers the performance requirements for silicon, fast recovery, power rectifier diodes. Four levels of product assurance are provided for each encapsulated device types as specified in MIL-PRF-19500. Two levels of product assurance are provided for each unencapsulated device type.

1.2 Physical dimensions. See figures 1 through 6.

1.3 Maximum ratings. Unless otherwise specified, T_A = +25°C.

* 1.3.1 Ratings applicable to all Part or Identifying Numbers (PIN). T_{STG} = $T_{J(max)}$ =-65°C to +175°C; (sinewave operation includes package limitation).

* 1.3.2 Ratings applicable to individual types.

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11
Types	V_{RWM}	$I_{O(L)}$ T_L = +75°C L = .375 in. (9.52 mm) (1)	$I_{O(PCB1)}$ T_A = +55°C (2)	$I_{O(PCB2)}$ T_A = +55°C (3)	I_{FSM} at +100°C Operating at I_{O2} t_p = 8.3 ms	t_{rr}	$R_{\theta JL}$ at L = .375 in. (9.52 mm)	$R_{\theta JEC}$ (4)	$R_{\theta JA(PCB1)}$	$R_{\theta JA(PCB2)}$
		A	A	A	A(pk)	ns	°C/W	°C/W	°C/W	°C/W
1N5802, US	50	2.5	.75	1.0	35	25	36	13	200	145
1N5804, US	100	2.5	.75	1.0	35	25	36	13	200	145
1N5806, US	150	2.5	.75	1.0	35	25	36	13	200	145
1N5807, US	50	6.0	1.7	3.0	125	30	22	6.5	95	50
1N5809, US	100	6.0	1.7	3.0	125	30	22	6.5	95	50
1N5811, US	150	6.0	1.7	3.0	125	30	22	6.5	95	50

See notes on next page.

* Comments, suggestions, or questions on this document should be addressed to Defense Supply Center, Columbus, ATTN: DSCC-VAC, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to Semiconductor@dscc.dla.mil . Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://assist.daps.dla.mil.

* 1.3.2 Ratings applicable to individual types - Continued.

(1) $T_{EC} = T_L$ at L = 0 or $T_{end\ tab}$ for US suffix devices.
(2) See 4.3.1 for derating curves and figures 7 through 10. T_A = +55°C for both axial and MELF (US) on printed circuit board (PCB), PCB = FR4 .0625 inch (1.59 mm) 1-layer 1-Oz Cu, horizontal, still air, pads (US) = .067 inch (1.70 mm) x .105 inch (2.67 mm); pads (axial) = .092 inch (2.34 mm) diameter, strip = .030 inch (0.762 mm) x 1 inch (25.4 mm) long, axial lead length L ≤ .187 inch (≤ 4.76 mm); $R_{\theta JA}$ with a defined thermal resistance condition included is measured at I_Z = as defined in test ratings herein.
(3) T_A = + 55°C for both axial and MELF (US) on printed circuit board (PCB), PCB = FR4 .0625 inch (1.59 mm); pad = .4 square inch (10.16 mm).
(4) US suffix devices only.

1.4 Primary electrical characteristics. Unless otherwise specified, T_A = +25°C.

Types	V_{BR}	I_{R1} at $V_R = V_{RWM}$ T_A = +25°C	I_{R2} at $V_R = V_{RWM}$ T_A = +100°C
	(V dc)	µA dc	µA dc
1N5802, US	60	1.0	50
1N5804, US	110	1.0	50
1N5806, US	160	1.0	50
1N5807, US	60	5.0	150
1N5809, US	110	5.0	150
1N5811, US	160	5.0	150

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

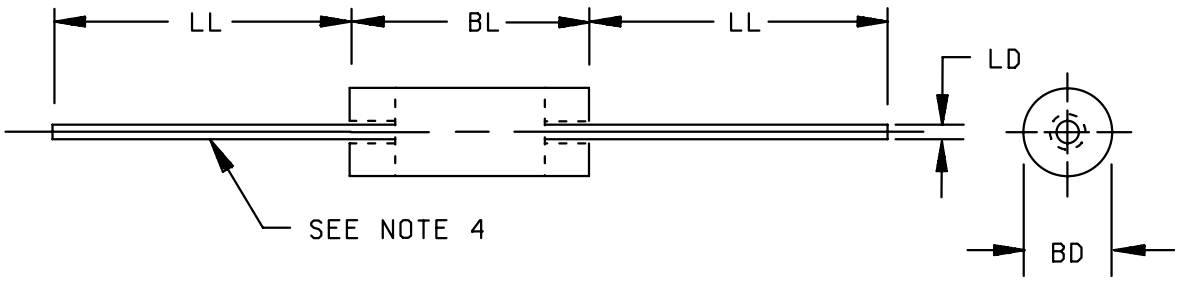
DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-19500 - Semiconductor Devices, General Specification for.

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-750 - Test Methods for Semiconductor Devices.

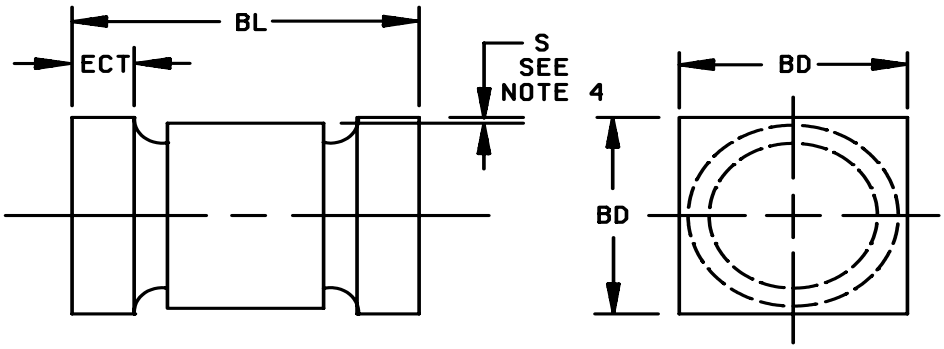
* (Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch/ or http://assist.daps.dla.mil. or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)



Ltr.	Dimensions								Notes
	1N5802, 1N5804, 1N5806				1N5807, 1N5809, 1N5811				
	Inches		Millimeters		Inches		Millimeters		
	Min	Max	Min	Max	Min	Max	Min	Max	
BD	.065	.085	1.65	2.16	.115	.165	2.92	4.19	4
BL	.125	.250	3.18	6.35	.130	.300	3.30	7.62	3
LD	.027	.032	0.69	0.81	.037	.042	0.94	1.07	3
LL	.700	1.30	17.78	33.02	.900	1.30	22.86	33.02	

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Dimension BL shall include the sections of the lead over which the diameter is uncontrolled. This uncontrolled area is defined as the zone between the edge of the diode body and extending .050 inch (1.27 mm) onto the leads.
4. Dimension BD shall be measured at the largest diameter. The BL dimension shall include the entire body including slugs.
5. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.

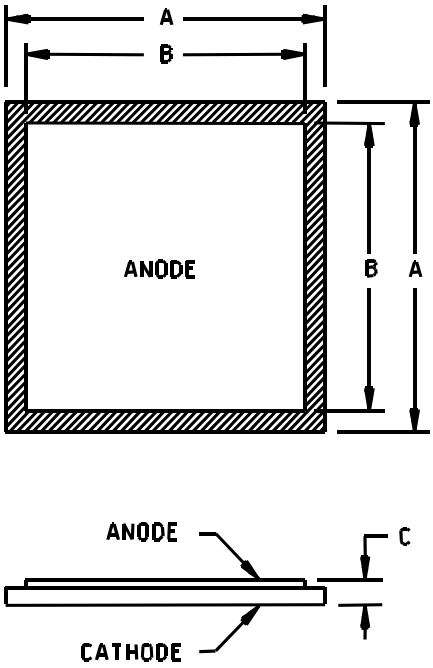
* FIGURE 1. Physical dimensions.



Ltr.	Dimensions								Notes
	D-5A 1N5802US, 1N5804US, 1N5806US				D-5B 1N5807US, 1N5809US, 1N5811US				
	Inches		Millimeters		Inches		Millimeters		
	Min	Max	Min	Max	Min	Max	Min	Max	
BD	.091	.103	2.31	2.62	.137	.148	3.48	3.76	
BL	.168	.200	4.27	5.08	.200	.225	5.08	5.72	
ECT	.019	.028	0.48	0.71	.019	.028	0.48	0.71	
S	.003		0.08		.003		0.08		

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Dimensions are pre-solder dip.
4. Minimum clearance of glass body to mounting surface on all orientations.
5. Cathode marking to be either in color band, three dots spaced equally, or a color dot on the face of the end tab.
6. Color dots will be .020 inch (0.51 mm) diameter minimum and those on the face of the end tab shall not lie within .020 inch (0.51 mm) of the mounting surface.
7. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.

* FIGURE 2. Physical dimensions of surface mount family.

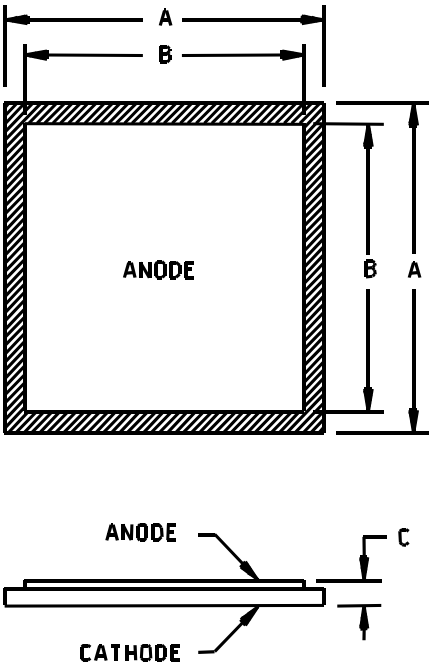


1N5802, 1N5804, 1N5806

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	.043	.047	1.10	1.20
B	.032	.036	0.82	0.92
C	.008	.012	0.20	0.30

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Anode is aluminum at 40,000 Å minimum.
4. Cathode is gold at 3,500 Å minimum.

* FIGURE 3. JANC die dimensions.

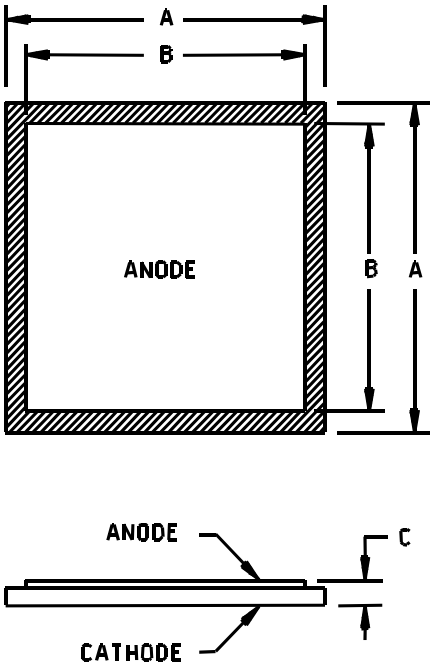


1N5807, 1N5809, 1N5811

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	.068	.072	1.73	1.83
B	.057	.061	1.45	1.55
C	.008	.012	0.20	0.30

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Anode is aluminum at 40,000 Å minimum.
4. Cathode is gold at 3,500 Å minimum.

* FIGURE 4. JANC (E-version) die dimensions.

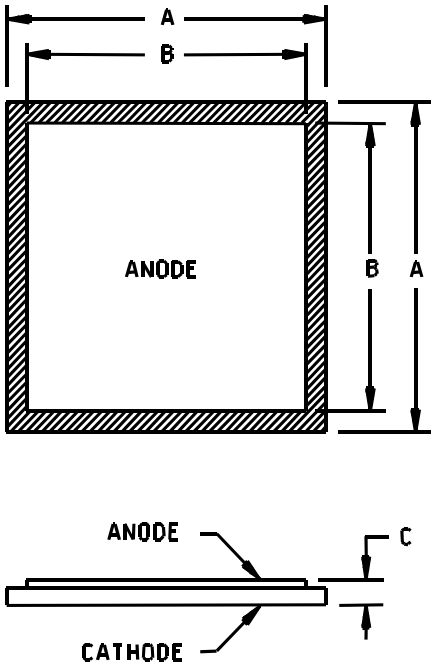


1N5802, 1N5804, 1N5806

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	.039	.043	1.00	1.09
B	.031	.035	0.79	0.89
C	.008	.012	0.20	0.30

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Anode is aluminum at 45,000 Å minimum.
4. Cathode is silver at 2,500 Å minimum.

FIGURE 5. JANC (F-version) die dimensions.



1N5807, 1N5809, 1N5811

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	.066	.070	1.68	1.78
B	.057	.061	1.45	1.55
C	.008	.012	0.20	0.30

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Anode is aluminum at 60,000 Å minimum.
4. Cathode is silver at 2,500 Å minimum.

FIGURE 6. JANC (F-version) die dimensions.

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 General. The individual item requirements shall be as specified in MIL-PRF-19500 and as modified herein.

3.2 Qualification. Devices furnished under this specification shall be products that are manufactured by a manufacturer authorized by the qualifying activity for listing on the applicable qualified manufacturer's list (QML) before contract award (see 4.2 and 6.3).

3.3 Abbreviations, symbols, and definitions. Abbreviations, symbols, and definitions used herein shall be as specified in MIL-PRF-19500 and as follows:

EC. . . . . End cap.
$I_{(BR)}$ . . . . . .Current for testing breakdown voltage.
V_{fr} . . . . . Forward recovery voltage.

3.4 Interface and physical dimensions. The interface and physical dimensions shall be as specified in MIL-PRF-19500, and figures 1 through 6 herein.

3.4.1 Diode construction. These devices shall be constructed utilizing non-cavity double plug construction with high temperature metallurgical bonding between both sides of the silicon die and terminal pins (see MIL-PRF-19500). Metallurgical bond shall be in accordance with the requirements of category I in MIL-PRF-19500. US version devices shall be structurally identical to the non-surface mount devices except for lead terminations.

3.4.2 Lead finish. Unless otherwise specified, lead or end-cap finish shall be solderable in accordance with MIL-PRF-19500, MIL-STD-750, and herein. When solder alloy is used for finish, the maximum lead temperature is limited to 175°C maximum. Where a choice of finish is desired, it shall be specified in the acquisition document (see 6.2).

3.5 Marking. Devices shall be marked as specified in MIL-PRF-19500.

3.5.1 Marking of US version. For US version only, all marking may be omitted from the device except for the cathode marking. All marking which is omitted from the body of the device shall appear on the label of the initial container.

3.5.2 Polarity. The polarity shall be indicated with a contrasting color band to denote the cathode end. Alternately, for surface mount (US) devices, a minimum of three evenly spaced contrasting color dots around the periphery of the cathode end may be used. No color coding will be permitted.

3.6 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in 1.3, 1.4, and table I herein.

3.7 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table I herein.

3.8 Workmanship. Semiconductor devices shall be processed in such a manner as to be uniform in quality and shall be free from other defects that will affect life, serviceability, or appearance.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.2).

b. Screening (see 4.3).

c. Conformance inspection (see 4.4) and tables I, II, and III.

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500 and as specified herein.

4.2.1 Group E qualification. Group E qualification shall be performed herein for qualification or requalification only. In case qualification was awarded to a prior revision of the specification sheet that did not request the performance of table II tests, the tests specified in table II herein that were not performed in the prior revision shall be performed on the first inspection lot to this revision to maintain qualification.

*4.2.1.1 Group E thermal impedance. Each supplier shall submit a thermal impedance ($Z_{\theta JX}$) histogram of the entire qualification lot. The histogram data shall be taken prior to the removal of devices that are atypical for thermal impedance. Thermal impedance curves (from $Z_{\theta JX}$ test pulse time to $R_{\theta JX}$ minimum steady-state time) of the best device in the qual lot and the worst device in the qual lot (that meets the supplier proposed screening limit), or from the thermal grouping, shall be submitted. The optimal test conditions and proposed initial thermal impedance screening limit shall be provided in the qualification report. Data indicating how the optimal test conditions were derived for $Z_{\theta JX}$ shall also be submitted. The proposed specification maximum thermal impedance curve shall be submitted. The qualifying activity may approve a different $Z_{\theta JX}$ limit not to exceed the specification's thermal curve for conformance inspection end-point measurements as applicable**.** Equivalent data, procedures, or statistical process control plans may be used for part, or all, of the above requirements. The approved thermal impedance conditions and limit for $Z_{\theta JX}$ shall be used by the supplier in screening and table I, subgroup 2. The approved thermal resistance conditions for $R_{\theta JX}$ shall be used by the supplier for conformance inspection. For product families with similar thermal characteristics based on the same physical and thermal die, package, and construction combination (thermal grouping), the supplier may use the same thermal impedance curves.

4.2.2 JANHC and JANKC die. Qualification shall be in accordance with appendix G of MIL-PRF-19500 and as specified herein.

* 4.3 Screening (JANS, JANTXV and JANTX levels only). Screening shall be in accordance with table IV of MIL-PRF-19500, and as specified herein. The following measurements shall be made in accordance with table I herein. Devices that exceed the limits of table I herein shall not be acceptable.

Screen (see table IV of MIL-PRF-19500)	JANS level	JANTXV and JANTX level
1a 1b	Required Required	Not required Required (JANTXV only)
2	Not required	Not required
3a (1) 3c	Required Thermal impedance (see 4.3.1)	Required Thermal impedance (see 4.3.1)
4	Not applicable	Not applicable
5	Not applicable	Not applicable
6	Not applicable	Not applicable
7a 7b	Not applicable Optional	Not applicable Optional
8	Required	Not required
9	I_{R1} and V_{FM1}	Not required
10	Method 1038 of MIL-STD-750, condition A	Method 1038 of MIL-STD-750, condition A
11	Required I_{R1} and V_{FM1}; ΔI_{R1} ± 100 percent of initial reading or ±150 nA dc(1N5802, 1N5804, 1N5806) or ±500 nA dc (1N5807, 1N5809, 1N5811), whichever is greater. $\Delta V_{FM1} \leq \pm 0.05$ V dc.	Required I_{R1} and V_{FM1}
12	Required, see 4.3.2	Required, see 4.3.2
(2) 13	Subgroups 2 and 3 of table I herein; $\Delta I_{R1} \leq 100$ percent of initial reading or ± 150 nA dc (1N5802, 1N5804, 1N5806) or ± 500 nA dc (1N5807, 1N5809, 1N5811), whichever is greater. $\Delta V_{FM1} \leq \pm 0.05$ V dc. Scope display evaluation (see 4.5.2)	Subgroup 2 of table I herein;ΔI_{R1} ± 100 percent of initial reading or ± 250 nA dc (1N5802, 1N5804, 1N5806) or ± 1 μA dc (1N5807, 1N5809, 1N5811), whichever is greater. $\Delta V_{FM1} \leq \pm 0.05$ V dc. Scope-display evaluation (see 4.5.2).
14a (3) 14b	Not applicable Required	Not applicable Required
15	Required	Not required
16	Required	Not required

(1) Shall be performed anytime after temperature cycling, screen 3a; and does not need to be repeated in screening requirements.
(2) $Z_{\theta JX}$ is not required in screen 13, if already previously performed.
(3) For clear glass diodes, the hermetic seal (gross leak) may be performed at any time after temperature cycling.

* 4.3.1 Thermal impedance. The thermal impedance measurements shall be performed in accordance with method 3101 or 4081 as applicable of MIL-STD-750 using the guidelines in that method for determining I_M, I_H, t_H, (and V_C where appropriate). t_{MD} shall be 70 μs maximum. (See figures 11 through 14.) Mounting condition, see figure 15 herein.

* 4.3.2 Free air power burn-in conditions. Power burn-in conditions are as follows (see 4.5.4.1): $I_{O(min)} = I_{O(PCB2)}$. T_A = 55°C maximum. Test conditions shall be in accordance with method 1038 of MIL-STD-750, condition B. Adjust I_O or T_A to achieve the required T_J. T_J = 135°C minimum. With approval of the qualifying activity and preparing activity, alternate burn-in criteria (hours, bias conditions, TJ, mounting conditions) may be used for JANTX and JANTXV quality levels. A justification demonstrating equivalence is required. In addition, the manufacturing site's burn-in data and performance history will be essential criteria for burn-in modification approval.

4.3.3 Screening (JANHC and JANKC). Screening of die shall be in accordance with appendix G of MIL-PRF-19500. As a minimum, die shall be 100-percent probed to ensure compliance with table I, subgroup 2. Burn-in duration for the JANKC level follows JANS requirements; the JANHC follows JANTX requirements.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500 and as specified herein.

* 4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with MIL-PRF-19500, and table I herein.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the tests and conditions specified for subgroup testing in table VIa (JANS) and table VIb (JAN, JANTX, and JANTXV) of MIL-PRF-19500 and herein. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein. See table III herein for delta limits when applicable.

* 4.4.2.1 Group B inspection, table VIa (JANS) of MIL-PRF-19500.

Subgroup	Method	Condition
B3	1056	Thermal shock, 0°C to +100°C, 25 cycles.
B3	1051	Temperature cycling, -55°C to +175°C, 100 cycles.
B3	4066	I_{FSM} = rated I_{FSM} (see col. 6 of 1.3.2); 10 surges of 8.3 ms each at 1 minute intervals, superimposed on I_O = 0, V_{RWM} = 0.
B4	1037	$I_O = I_{O(PCB2)}$ rated minimum (see 1.3.2); V_R = rated V_{RWM} (see 1.3.2 and 4.5.4); 2,000 cycles.
B5	1027	$I_O = I_{O(PCB2)}$ rated minimum (see col. 5 of 1.3.2); apply V_R = rated V_{RWM} (see col. 2 of 1.3.2, and 4.5.4.1) adjust I_O to achieve T_J minimum; f = 50-60 Hz.
		Option 1: T_J = 225°C minimum; n = 45, c = 0, t = 216 hours.
	or	Option 2: T_J = 200°C minimum; n = 45, c = 0, t = 1,000 hours.
B6	4081	$R_{\theta JL}$ (maximum) see col. 8 of 1.3.2 and 4.3.1 herein L = .375 inch (9.53 mm). For surface mount devices (US version), $R_{\theta JEC}$ see col. 9 of 1.3.2 and 4.3.1 herein.
B7		Peak reverse power, see 4.5.3. $P_{RM} \geq$ 1,000 W. Test shall be performed on each sublot; sampling plan n = 10, c = 0, electrical end-points, see table I, subgroup 2 herein.

* 4.4.2.2 Group B inspection, table VIb (JAN, JANTX, and JANTXV of MIL-PRF-19500).

Subgroup	Method	Condition
B2	1056	Thermal shock, 0°C to +100°C, 10 cycles.
B2	1051	Temperature cycling, -55°C to +175°C, 25 cycles.
B3	1027	$I_O = I_{O(PCB2)}$ rated minimum (see col. 5 of 1.3.2); adjust I_O to achieve T_J = 150° C minimum, apply V_R = rated V_{RWM} (see col. 2 of 1.3.2), f = 50-60 Hz (see 4.5.4.1). T_A = 55°C (max).
B5		Not applicable.

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table VII of MIL-PRF-19500. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein. See table III herein for delta limits when applicable.

* 4.4.3.1 Group C inspection, table VII of MIL-PRF-19500.

Subgroup	Method	Condition
C2	1056	Thermal shock, 0°C to +100°C, 10 cycles.
C2	1051	Temperature cycling, -55°C to +175°C, 20 cycles.
C2	2036	Tension: Condition A, 12 pounds, t = 15s - 1N5802, 1N5804, 1N5806. 20 pounds - 1N5807, 1N5809, 1N5811 Fatigue: Condition E, 2 pounds. NOTE: Not applicable for US devices.
C5	4081	$R_{\theta JL}$(maximum) see col. 8 of 1.3.2 and 4.3.1 herein L = .375 inch (9.53 mm). For surface mount devices (US version), $R_{\theta JEC}$ see col. 9 of 1.3.2 and 4.3.1 herein.
C6	1027	$I_O = I_{O(PCB2)}$ rated minimum (see col. 5 of 1.3.2); adjust I_O to achieve T_J = 150° C minimum, apply V_R = rated V_{RWM} (see col. 2 of 1.3.2), f = 50-60 Hz (see 4.5.4.1). T_A = 55°C (max).

4.4.4 Group E inspection. Group E inspection shall be conducted in accordance with the conditions specified for subgroup testing in appendix E, table IX of MIL-PRF-19500 and as specified herein. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein. See table III herein for delta limits when applicable.

4.5 Methods of inspection. Methods of inspection shall be as specified in the appropriate tables as follows.

4.5.1 Pulse measurements. Conditions for pulse measurement shall be as specified in section 4 of MIL-STD-750.

4.5.2 Scope display evaluation. Scope display evaluation shall be stable in accordance with method 4023 of MIL-STD-750, condition A. Scope display may be performed on ATE (automatic test equipment) for screening only with the approval of the qualifying activity. Scope display in table I, subgroup 4 shall be performed on a scope. The reverse current (I_{BR}) over the knee shall be 500 μA peak.

4.5.3 Peak reverse power test. A 20 microsecond half-sine waveform of current shall be used and peak reverse power shall be determined by the product of peak reverse voltage and peak reverse current. A 20 microsecond square waveform may also be used with the approval of the qualifying activity (see figure 16).

4.5.4 Burn-in and life tests. These tests shall be conducted with a half-sine waveform of the specified peak voltage impressed across the diode in the reverse direction followed by a half-sine waveform of the specified average rectified current. The forward conduction angle of the rectified current shall be neither greater than 180 degrees, nor less than 150 degrees.

* 4.5.4.1 Free air burn-in and life tests. The use of a current limiting or ballast resistor is permitted provided that each DUT still sees the full P_t (minimum) and that the minimum applied voltage, where applicable, is maintained through-out the burn-in period. Use method 3100 of MIL-STD-750 to measure T_J.

* TABLE I. Group A inspection.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 1						
Visual and mechanical examination	2071					
Subgroup 2						
Thermal impedance 2/	3101	See 4.3.1	$Z_{\theta JX}$			
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US						°C/W
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US						°C/W
Forward voltage	4011	Duty cycle ≤ 2 percent (pulsed see 4.5.1); t_p = 8.3 ms (max)	V_{FM1}			
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US		I_{FM} = 1.0 A(pk)			0.875	V (pk)
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US		I_{FM} = 4.0 A(pk)			0.875	V (pk)
Forward voltage	4011	Duty cycle ≤ 2 percent (pulsed see 4.5.1); t_p = 8.3 ms (max)	V_{FM2}			
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US		I_{FM} = 2.5 A(pk)			0.975	V (pk)
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US		I_{FM} = 6.0 A(pk)			0.925	V(pk)
Reverse current	4016	DC method	I_{R1}			
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US		V_R = 50 V dc V_R = 100 V dc V_R = 150 V dc			1.0 1.0 1.0	µA dc µA dc µA dc
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US		V_R = 50 V dc V_R = 100 V dc V_R = 150 V dc			5.0 5.0 5.0	µA dc µA dc µA dc

See footnotes at end of table.

* TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 2 – Continued.						
Breakdown voltage	4021	$I_{(BR)}$ = 100 μA dc	$V_{(BR)1}$			
1N5802, 1N5802US 1N5807, 1N5807US				60		V dc
1N5804, 1N5804US 1N5809, 1N5809US				110		V dc
1N5806, 1N5806US 1N5811, 1N5811US				160		V dc
Subgroup 3						
High temperature operation:		T_A = +125°C-minimum.				
Reverse current	4016	DC method	I_{R2}			
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US		V_R = 50 V dc V_R = 100 V dc V_R = 150 V dc			50 50 50	μA dc μA dc μA dc
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US		V_R = 50 V dc V_R = 100 V dc V_R = 150 V dc			150 150 150	μA dc μA dc μA dc
Forward voltage	4011	Duty cycle ≤ 2 percent (pulsed see 4.5.1); t_p = 8.3 ms (max)	V_{FM3}			
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US		I_{FM} = 1.0 A(pk)			0.800	V (pk)
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US		I_{FM} = 4.0 A(pk)			0.800	V (pk)
Low-temperature operation:		T_A = -65°C minimum.				
Forward voltage	4011	Duty cycle ≤ 2 percent (pulsed see 4.5.1); t_p = 8.3 ms (max)	V_{FM4}			
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US		I_{FM} = 1.0 A(pk)			1.075	V (pk)
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US		I_{FM} = 4.0 A(pk)			1.075	V (pk)

See footnotes at end of table.

* TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 3 – Continued.						
Breakdown voltage	4021	$I_{(BR)}$ = 100 μA dc	$V_{(BR)2}$			
1N5802, 1N5802US 1N5807, 1N5807US				50		V dc
1N5804, 1N5804US 1N5809, 1N5809US				100		V dc
1N5806, 1N5806US 1N5811, 1N5811US				150		V dc
Subgroup 4						
Reverse recovery time	4031	Condition B	t_{rr}			
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US		$I_F = I_R$ = 0.5 A I_{RM} (REC) = 0.05 A(pk) di/dt = 65 A/μs (min)			25	ns
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US		$I_F = I_R$ = 1.0 A $I_{RM(REC)}$ = 0.1 A(pk) di/dt = 100 A/μs (min)			30	ns
Capacitance	4001	V_R = 10 V; f = 1 Mhz; V_{sig} = 50 mV (p-p)	C_J			
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US					25	pF
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US					60	pF
Forward recovery voltage	4026	t_r = 8 ns	V_{FRM}			
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US		I_{FM} = 250 mA			2.2	V (pk)
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US		I_{FM} = 500 mA			2.2	V (pk)

See footnotes at end of table.

* TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 4 – Continued.						
Forward recovery time	4026	$t_p \geq 20$ ns, $t_r = 8$ ns, the test is measured at $V_{FR} = 1.1 \times V_F$	t_{fr}			
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US		$I_{FM} = 250$ mA			15	ns
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US		$I_{FM} = 500$ mA			15	ns
Scope display evaluation	4023	See 4.5.2, n = 116, c = 0				
Subgroup 5						
Not applicable						
Subgroup 6						
Forward surge	4066	I_{FSM} = rated (see 1.3.2); 10 surges of 8.3 ms each at 1 minute intervals superimposed on $I_O = I_{O2}$ rated (see 1.3.2); V_{RWM} = rated (see 1.3.2); T_A = + 25°C.				
Electrical measurements		See table I, subgroup 2 except $Z_{\theta JX}$.				
Subgroup 7						
Not applicable						

1/ For sampling plan, see MIL-PRF-19500.
2/ Not applicable to JANHC and JANKC devices.

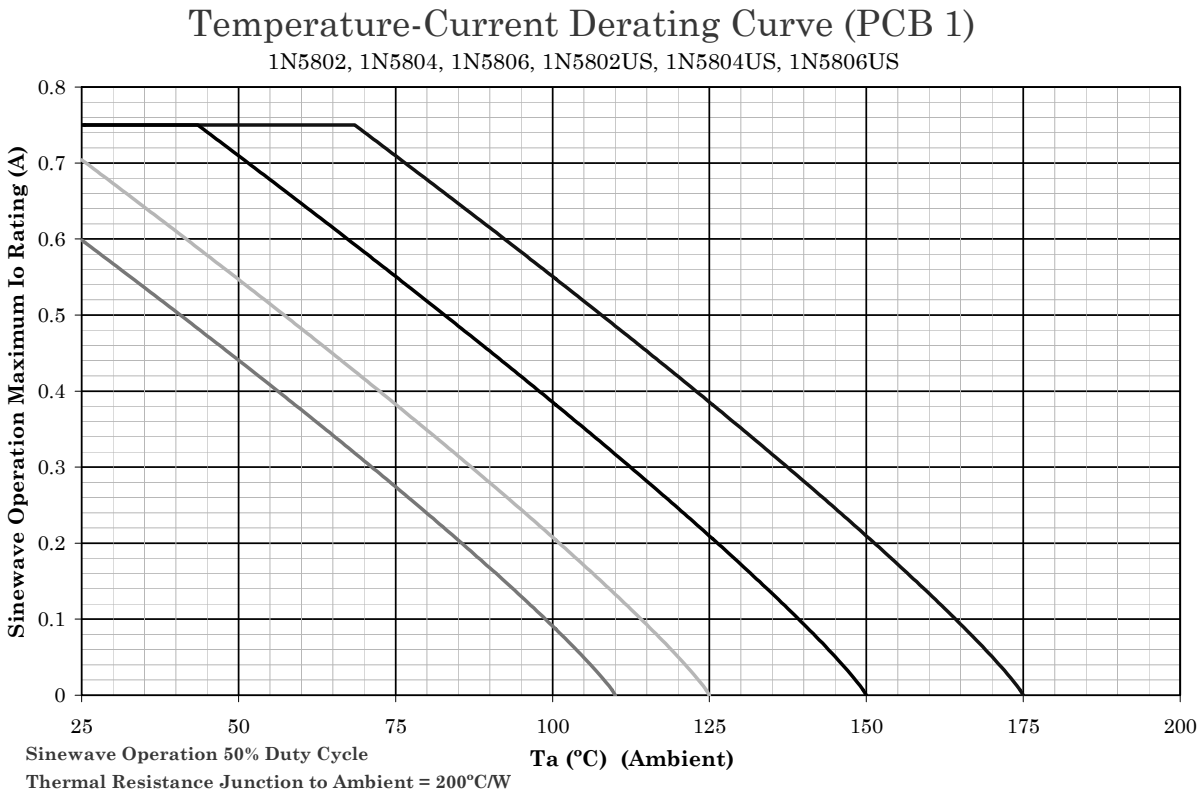
* TABLE II. Group E inspection (all quality levels) for qualification and requalification only.

Inspection	MIL-STD-750		Sampling plan
	Method	Conditions	
Subgroup 1			45 devices c = 0
Thermal shock (liquid to liquid)	1056	20 cycles, condition D except low temperature shall be achieved using liquid nitrogen (-195°C). Perform a visual for cracked glass.	
Temperature cycling (air to air)	1051	-65°C to +175°C, 500 cycles.	
Hermetic seal	1071		
Electrical measurement		See table I, subgroup 2 and table III, steps 1 and 2.	
Subgroup 2			22 devices c = 0
Steady-state dc blocking life	1048	t = 1,000 hours; T_A = +150°C; V_R DC = 80 - 85 percent rated V_{RWM} (see 1.3.2)	
Electrical measurement		See table I, subgroup 2, except $Z_{\theta JX}$ need not to be performed, and table III, steps 1 and 2.	
Subgroup 4			Sample size N/A
Thermal impedance curves		See 4.2.1.1	
Subgroup 5 and 6			
Not applicable			
Subgroup 7			n = 45
Resistance to glass cracking	1057	Step stress to destruction by increasing cycles or up to a maximum of 25 cycles.	
Subgroup 8			
Peak reverse power		See 4.5.3 and figure 16 herein. Peak reverse power, (P_{RM})= shall be characterized by the supplier and this data shall be available to the Government. Test shall be performed on each sublot.	
Electrical measurement		During the P_{RM} test, the voltage (V_{BR}) shall be monitored to verify it has not collapsed. Any collapse in V_{BR} during or after the P_{RM} test or rise in leakage current (I_R) after the test that exceeds I_{R1} in table I shall be considered a failure to that level of applied P_{RM}. Progressively higher levels of P_{RM} shall be applied until failure occurs on all devices within the chosen sample size to characterize each sublot.	
Subgroup 10			22 devices c = 0
Forward surge	4066	Condition A, I_{FSM} = rated (see 1.3.2); 10 surges of 8.3 ms each at 1 minute intervals superimposed on I_O = I_{O2} rated (see 1.3.2); V_{RWM} = rated (see 1.3.2); T_A = + 25°C.	
Electrical measurement		See table I, subgroup 2.	

* TABLE III. Group A, B, C, and E delta requirements. 1/ 2/ 3/ 4/ 5/

Step	Inspection	MIL-STD-750		Symbol	Limit	Unit
		Method	Conditions			
1.	Forward voltage	4011	Duty cycle ≤ 2 percent (pulsed see 4.5.1); t_p = 8.3 ms (max)	ΔV_{FM1}		
	1N5802, 1N5804, 1N5806, 1N5802US, 1N5804US, 1N5806US		I_{FM} = 1.0 A(pk)		± 50 mV dc change from of initial value	
	1N5807, 1N5809, 1N5811, 1N5807US, 1N5809US, 1N5811US		I_{FM} = 4.0 A(pk)			
2.	Reverse current	4016	DC method	ΔI_{R1}		
	1N5802,1N5802US 1N5804,1N5804US 1N5806,1N5806US		V_R = 50 V dc V_R = 100 V dc V_R = 150 V dc		100-percent or ±150 nA dc change from initial reading, whichever is greater.	
	1N5807,1N5807US 1N5809,1N5809US 1N5811,1N5811US		V_R = 50 V dc V_R = 100 V dc V_R = 150 V dc		100-percent or ±500 nA dc change from initial reading, whichever is greater.	

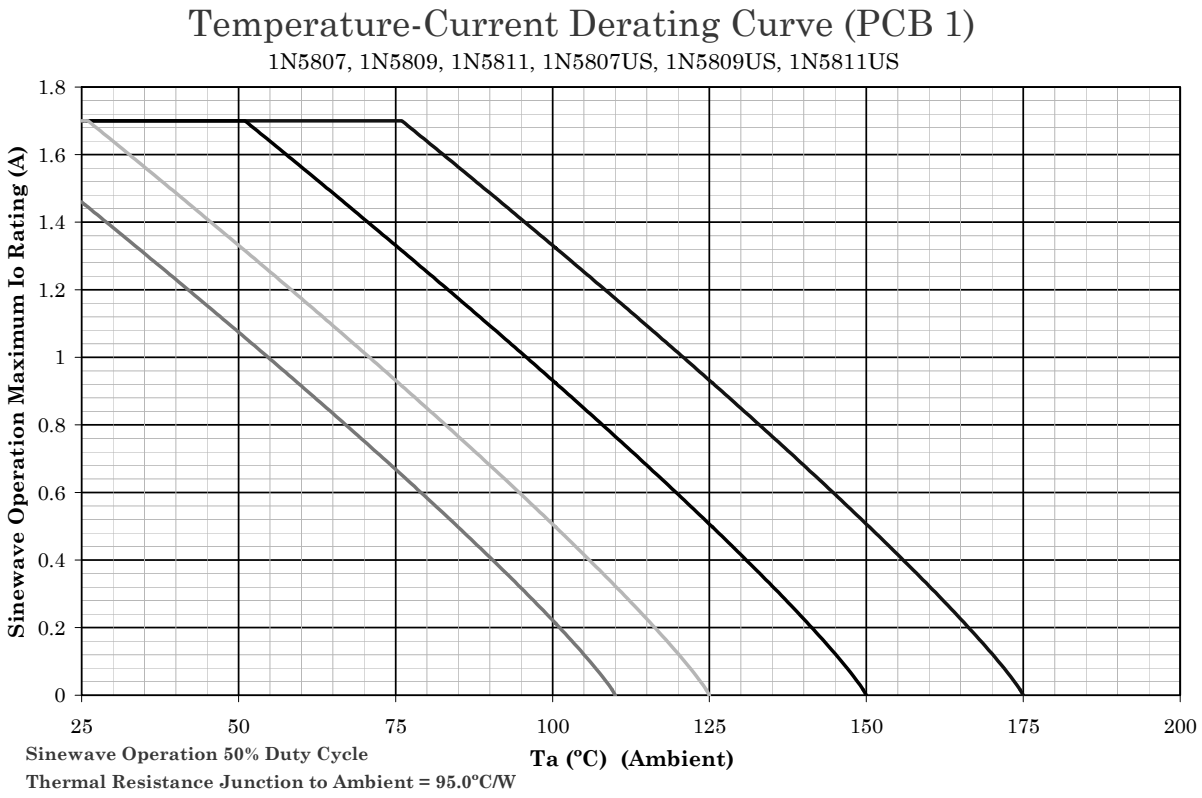
1/ Devices which exceed the table I limits for this test shall not be accepted.
2/ The electrical measurements for table VIa (JANS) of MIL-PRF-19500 are as follows: Subgroups 4 and 5, see table III herein, steps 1 and 2.
3/ The electrical measurements for table VIb (JAN, JANTX, and JANTXV) of MIL-PRF-19500 are as follows: Subgroup 3, see table III herein, steps 1 and 2.
4/ The electrical measurements for table VII (all quality levels) of MIL-PRF-19500 are as follows: Subgroup 6, see table III herein, steps 1 and 2.
5/ The electrical measurements for table IX of MIL-PRF-19500 are as follows: Subgroups 1 and 2, see table III herein, steps 1 and 2.



NOTES:

1. All devices are capable of operating at ≤ T_J specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum T_J allowed.
2. Derate design curve constrained by the maximum junction temperature (T_J ≤ 175°C) and current rating specified. (See 1.3 herein.)
3. Derate design curve chosen at T_J ≤ 125°C, where the maximum temperature of electrical test is performed.
4. Derate design curves chosen at T_J ≤, 125°C, and 110°C to show current rating where most users want to limit T_J in their application.

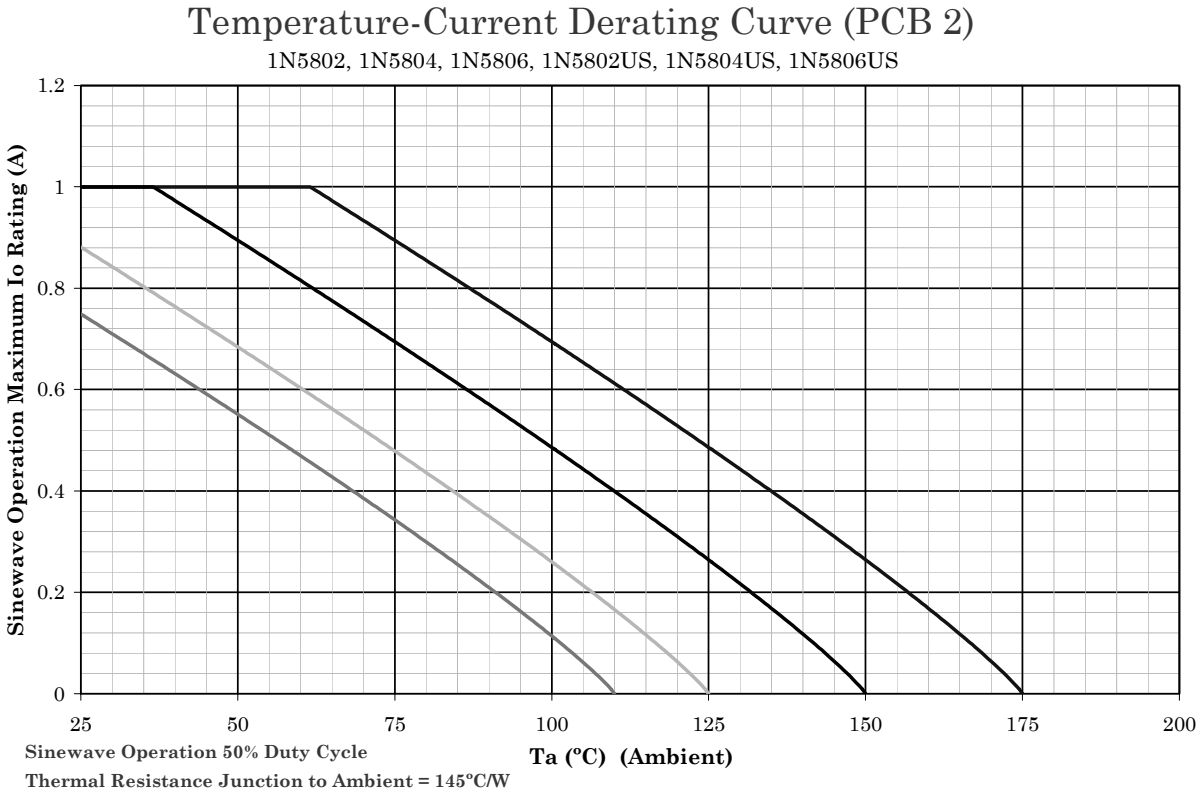
* FIGURE 7. Temperature-current derating curve.



NOTES:

1. All devices are capable of operating at ≤ T_J specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum T_J allowed.
2. Derate design curve constrained by the maximum junction temperature (T_J ≤ 175°C) and current rating specified. (See 1.3 herein.)
3. Derate design curve chosen at T_J ≤ 125°C, where the maximum temperature of electrical test is performed.
4. Derate design curves chosen at T_J ≤, 125°C, and 110°C to show current rating where most users want to limit T_J in their application.

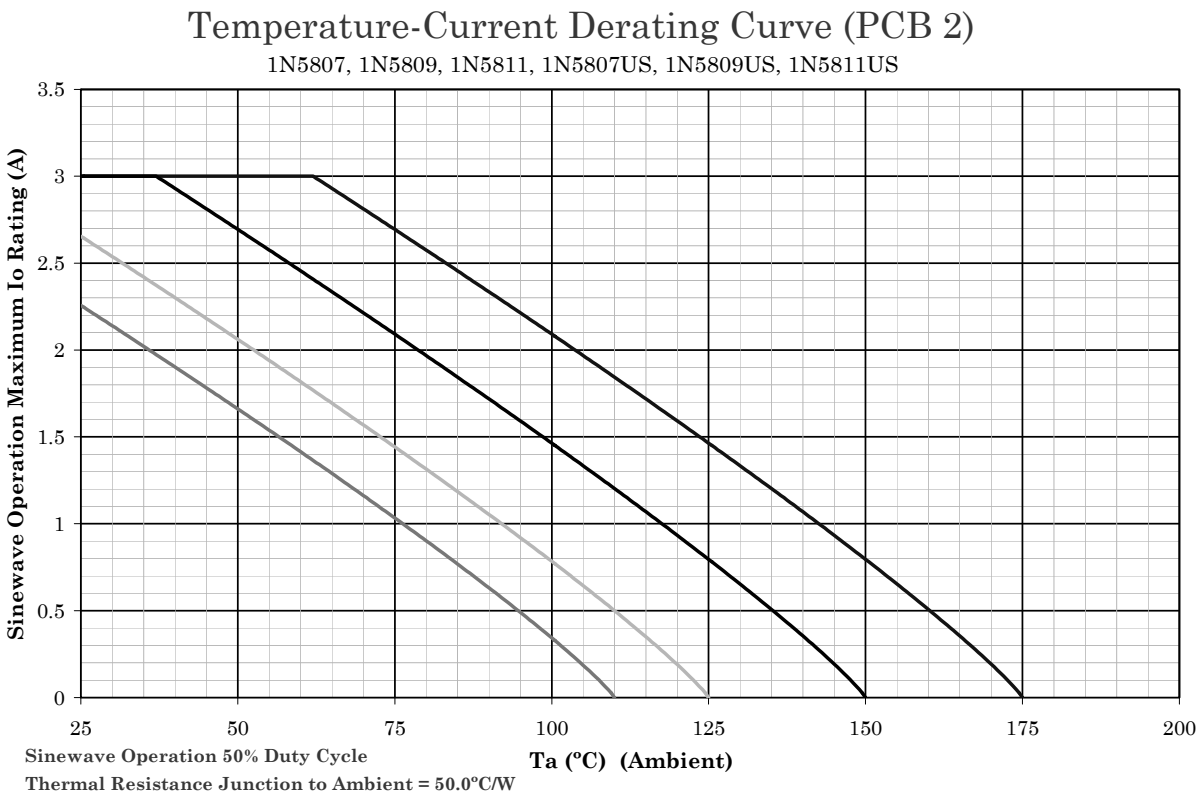
* FIGURE 8. Temperature-current derating curve.



NOTES:

1. All devices are capable of operating at $\leq T_J$ specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum T_J allowed.
2. Derate design curve constrained by the maximum junction temperature ($T_J \leq 175°C$) and current rating specified. (See 1.3 herein.)
3. Derate design curve chosen at $T_J \leq 125°C$, where the maximum temperature of electrical test is performed.
4. Derate design curves chosen at $T_J \leq$, 125°C, and 110°C to show current rating where most users want to limit T_J in their application.

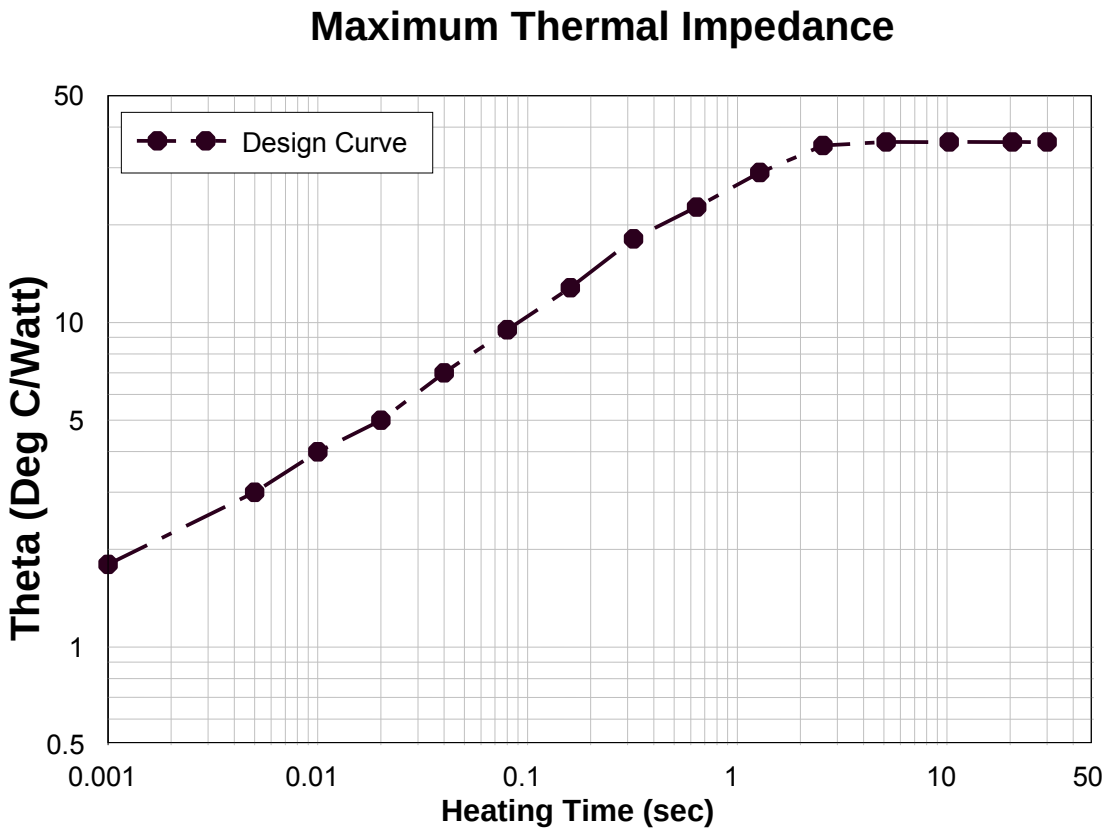
* FIGURE 9. Temperature-current derating curve.



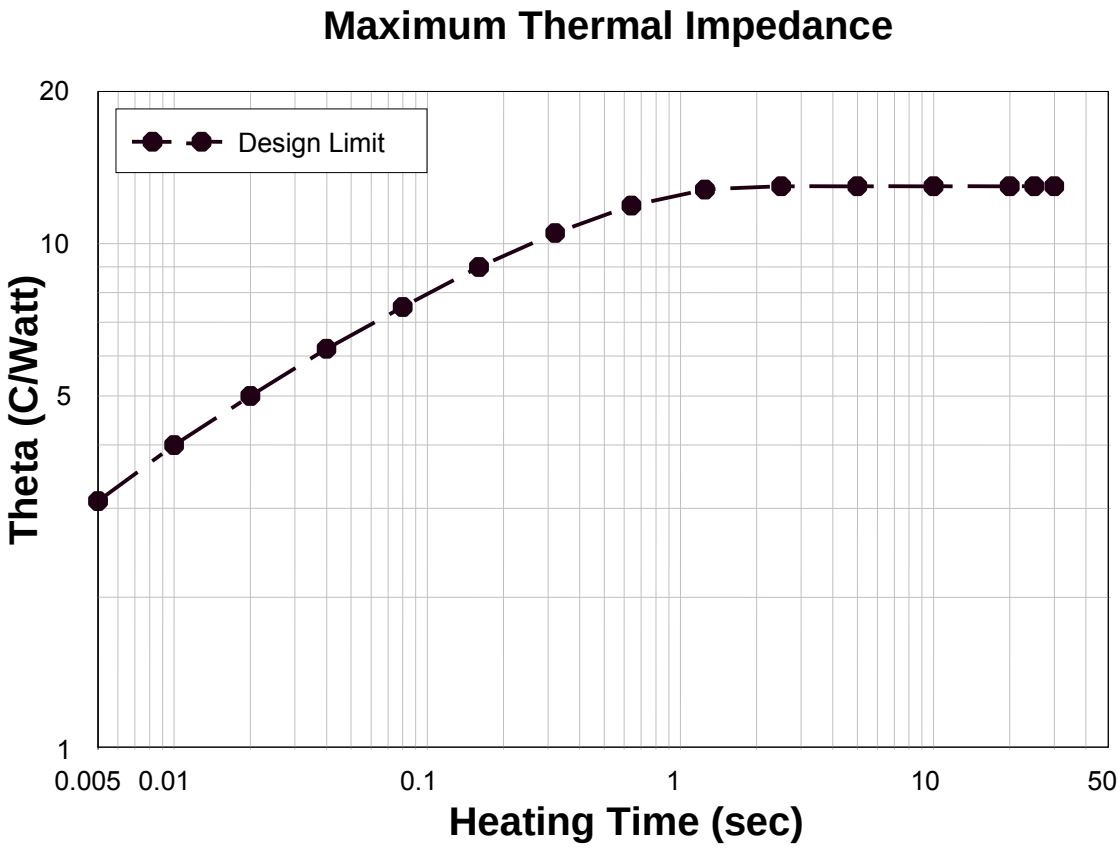
NOTES:

1. All devices are capable of operating at ≤ T_J specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum T_J allowed.
2. Derate design curve constrained by the maximum junction temperature (T_J ≤ 175°C) and current rating specified. (See 1.3 herein.)
3. Derate design curve chosen at T_J ≤ 125°C, where the maximum temperature of electrical test is performed.
4. Derate design curves chosen at T_J ≤, 125°C, and 110°C to show current rating where most users want to limit T_J in their application.

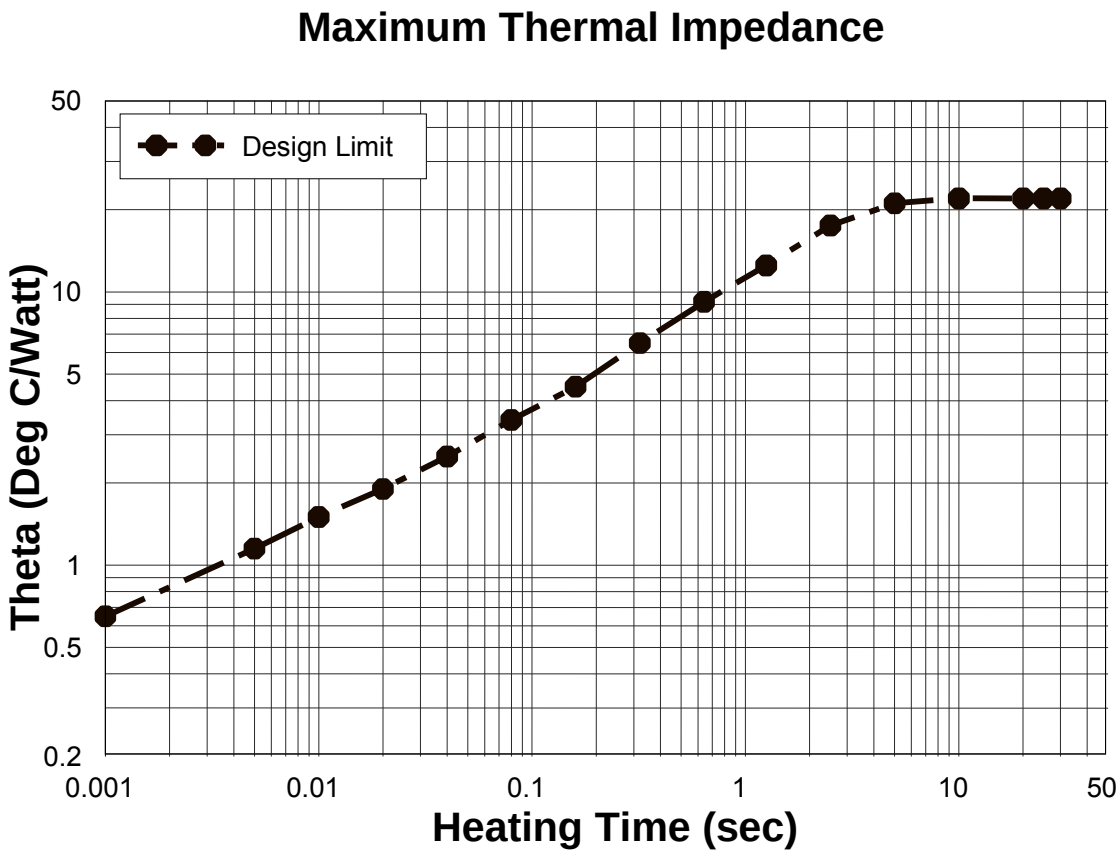
* FIGURE 10. Temperature-current derating curve.



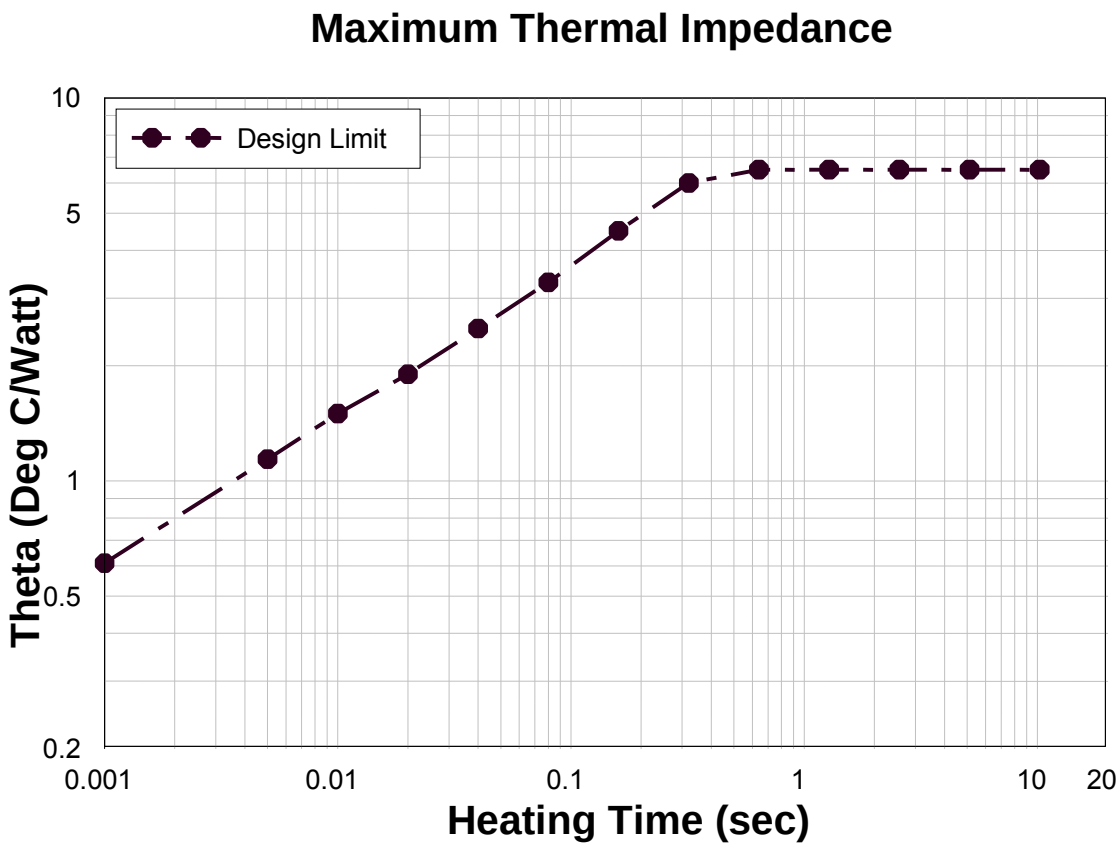
* FIGURE 11. Thermal impedance curve, $R_{\theta JL}$ = 36°C/W for 1N5802, 1N5804, and 1N5806.



* FIGURE 12. Thermal impedance curve $R_{\theta JEC}$ = 13°C/W for 1N5802US, 1N5804US, and 1N5806US.



* FIGURE 13. Thermal impedance curve $R_{\theta JL}$ = 22°C/W for 1N5807, 1N5809, and 1N5811.



* FIGURE 14. Thermal impedance curve $R_{\theta JEC}$ = 6.5°C/W for 1N5807US, 1N5809US, and 1N5811US.

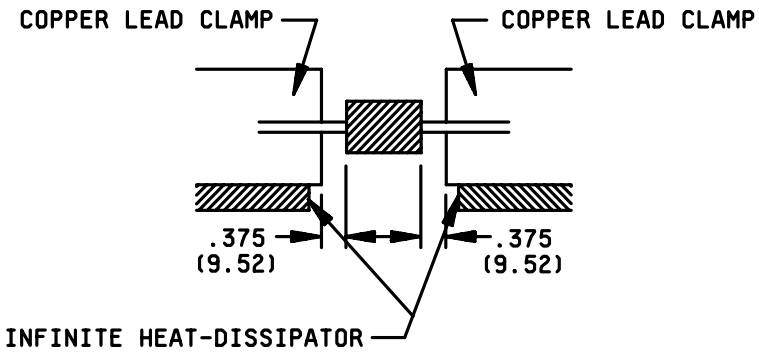
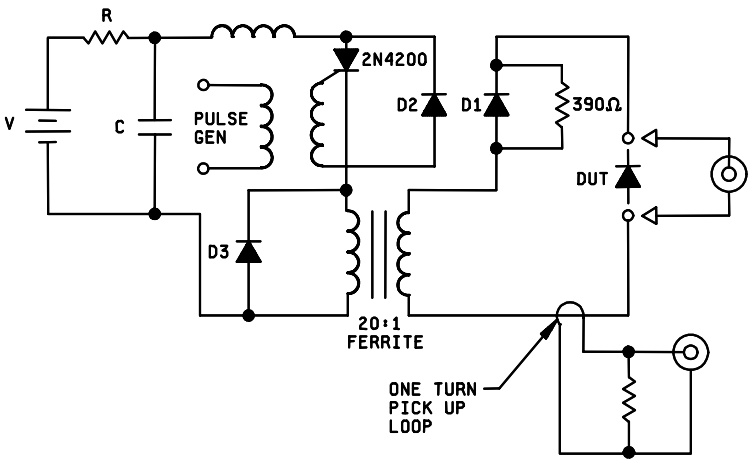
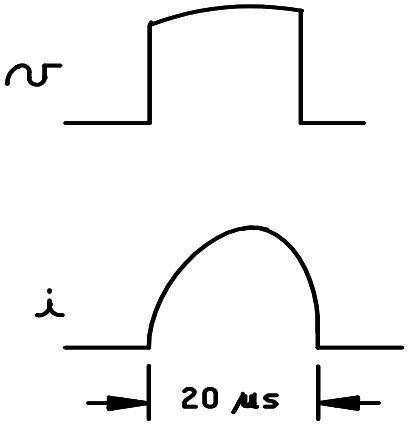


FIGURE 15. Mounting arrangement.



NOTES: *

L = 13T H22 on 1inch (25.4 mm) diameter form (air core).
C ~ 1 to 10 μfd to give 20 μs pulse width.
V - Adjustable to 200 volts for power desired in DUT.
D1 - 3 kV; 600 mA (1N3647 or equivalent).
D2, D3 - 600 V; 3A (1N5552 or equivalent).
* Values not stated are determined at the time of test.



TYPICAL WAVE FORMS

FIGURE 16. Peak reverse power measurement circuit and waveform.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the Military Service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The notes specified in MIL-PRF-19500 are applicable to this specification.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.

b. Packaging requirements (see 5.1).

c. Lead finish (see 3.4.2).

d. Product assurance level and type designator.

f. For die acquisition, the JANHC or JANKC letter version shall be specified (see figures 3, 4, 5, and 6).

* 6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Manufacturers List (QML 19500) whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Supply Center, Columbus, ATTN: DSCC/VQE, P.O. Box 3990, Columbus, OH 43218-3990 or e-mail vqe.chief@dla.mil.

6.4 Suppliers of die. The qualified die suppliers with the applicable letter version (example; JANHCE1N5802) will be identified on the QML.

6.5 Changes from previous issue. The margins of this specification are marked with asterisks to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:
Army - CR
Navy - EC
Air Force - 11
NASA - NA
DLA - CC

Review activities:
Army - AR, AV, MI, SM
Navy - AS, MC
Air Force - 19, 71, 99

Preparing activity:
DLA - CC

(Project 5961-2988)

* NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at http://assist.daps.dla.mil.